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ESTABLISHING AND CARING FOR LAWNS AND TURF.
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ONE OF A SERIES DESIGNED TO PREPARE HIGH SCHOOL STUDENTS FOR HORTICULTURE SERVICE OCCUPATIONS, THIS MODULE HAS AS ITS MAJOR OBJECTIVE TO DEVELOP THE ABILITY TO ESTABLISH AND MAINTAIN LAWNS AND TURF. IT WAS DEVELOPED ON THE BASIS OF DATA FROM STATE STUDIES BY A NATIONAL TASK FORCE. SUBJECT MATTER AREAS ARE NEW LAWN ESTABLISHMENT, LAWN MAINTENANCE, AND POOR LAWN REPAIR OR RENOVATION. SUGGESTIONS ARE INCLUDED FOR INTRODUCTION OF THE MODULE, SPECIFIC UNIT OBJECTIVES, SUBJECT MATTER CONTENT, TEACHING-LEARNING ACTIVITIES, INSTRUCTIONAL MATERIALS AND REFERENCES, AND CRITERIA FOR STUDENT EVALUATION. THE MODULE IS SCHEDULED FOR 15 HOURS OF CLASS INSTRUCTION, 30 HOURS OF LABORATORY EXPERIENCE, AND 55 HOURS OF OCCUPATIONAL EXPERIENCE. TEACHERS WITH A BACKGROUND IN HORTICULTURE MAY USE THIS GUIDE TO PREPARE A UNIT FOR LESS ABLE HIGH SCHOOL STUDENTS WITH AN OCCUPATIONAL GOAL IN ORNAMENTAL HORTICULTURE. THIS DOCUMENT IS AVAILABLE FOR A LIMITED PERIOD AS PART OF A SET (VT 000 619 - 000 631) FOR $7.25 FROM THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION, THE OHIO STATE UNIVERSITY, 980 KINNEAR ROAD, COLUMBUS, OHIO 43212. (JM)

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ESTABLISHING AND CARING FOR LAWNS AND TURF

One of Twelve Modules in the Course Preparing for Entry in

HORTICULTURE - SERVICE OCCUPATIONS

Module No. 9

The Center for Research and Leadership Development

in Vocational and Technical Education

The Ohio State University
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Columbus, Ohio, 43212

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RE: (Author, Title, Publisher, Date) **Module No. 9, "Establishing and Caring for Lawns and Turf," The Center for Vocational and Technical Education, August, 1965.**

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Users of Material Teachers

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ESTABLISHING AND CARING FOR LAWNS AND TURF

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ESTABLISHING AND CARING FOR LAWNS AND TURF

Major Teaching Objective

To establish and maintain lawns and turf

Suggested Time Allotment:

At school

Class instruction	15	hours
Laboratory experience	30	hours
Total at school	45	hours
Occupational experience	55	hours
Total for module	100	hours

Suggestions for Introducing the Module

The importance and extent of lawn grass use in landscapes is often underestimated, since most people tend to notice only unsightly lawns or trees and shrubs. But no matter how many expensive trees and shrubs are used, no landscape can be complete without a good lawn as background.

Have the students discuss specific neighborhood areas where lawn grasses are used. Make a list on the board of these situations. The list might include:

- Around homes
- Around new factories
- In parks
- In cemeteries
- On ballfields
- On golf courses
- Along highways
- Around public buildings
- Around airports

Show some colored slides of more or less typical uses of lawns in or around the area improved.

As the slides are shown, ask the students to visualize the setting shown if the lawn were not there. Show some public places which have lawns in poor condition. Would these places be improved if the lawn areas were improved?

Develop through discussion a list of the reasons why lawn areas are valuable to people. The following are examples:

1. They are attractive

2. They provide a setting for trees and shrubs.

3. They cover the soil, preventing dust and mud.

4. They prevent soil erosion and help control water runoff.

5. They provide a ground cover cushion for areas used in active sports.

6. They increase the sale value of the property.

7. They help "air condition" the home in summer, as temperatures are cooler above turf than above pavement.

Competencies to be Developed

I. To establish a new lawn

Teacher Preparation

Subject Matter Content

The first step in establishing a lawn is to assess the present ground and grass condition to determine whether major grading is necessary, what the condition of the topsoil is, whether the old soil should be removed, and whether drainage is adequate. A complete plan should be developed before any construction work is begun.

If the grade is rough, as left by the builder, some major adjustments may be necessary, since the grade should slope away from the foundation of a building to prevent the accumulation of water. Where sod is already in existence, probably no major change in grade is necessary.

If the drainage of excess water is a problem, the grade may require adjustment, or a tile drainage system may be needed.

If the area has previously had a lawn, the physical condition of the soil may be acceptable. Around new buildings, however, construction work probably has removed or buried the topsoil deep, leaving only soil of too poor quality for plant growing. If much adjustment is required on the grade, extensive soil conditioning will probably be necessary to provide a good soil environment for the grass. In many cases, top soil is used to correct problems of poor soil. This may or may not be a satisfactory solution, depending upon the quality of the top soil. Often the top soil is expensive, difficult to obtain, weedy, and no better than the soil it was meant to replace. By practicing good soil management, such as using fertilizer and organic matter, such as peat moss to grow grass, poor soils can be

improved, thereby reducing many of the problems associated with importing top soil. Care should be exercised in using compost and manure for increasing the organic matter content of the soil, as a severe weed problem may result.

After the grade has been established and the soil improved, the entire area should be worked at least three to six inches deep, and firmed with a roller or allowed to settle.

Fertilizer should be applied evenly at this stage. Consult state extension service circulars for area recommendations.

The soil should be raked level to incorporate the fertilizer into the upper layer of the soil and to provide a beneficial environment for seeds, since they should never come into direct contact with fertilizer.

The method of planting lawn grasses is determined by a variety of conditions. Seeding is the most economical, but is slow, unlike sodding, and is limited, because of washout, to relatively level ground.

Grasses which produce an abundance of creeping stems, such as some bentgrasses and Bermudagrasses are propagated by planting sections of the creeping stems, called stolons, which root and develop new top growth; but this method does not provide immediate cover.

Seeds of these grass mixtures are often preferable to the use of individual grasses. Sod is used where immediate effect or the covering of gentle slopes is desired. It is the most expensive method of establishing a lawn.

Soil preparation for seeding, planting stolons, and sodding should be the same, even though sod is an already established grass. Since sod must develop an extensive root system into the soil upon which it is placed to endure satisfactorily, the soil preparation should be the same as for seeds or stolons.

Because most grass seeds are quite small, even distribution is difficult. Use of a seeder is recommended, although lawns can be properly seeded by hand. The usual method of seed-sowing is to distribute half the required amount by running the seeder in parallel strips close enough to give uniform coverage. The remaining half of the seed is distributed in the same fashion, but at right angles to the previously sown strips. After seeding, the surface should be carefully raked to cover the seeds very lightly. A light mulch, such as straw or peat, may be applied, although many synthetic mulches are now available.

In order for seed germination to occur, a uniform supply of moisture, which can be maintained by mulches, is necessary. Mulches also protect seeds from birds and enhance growth to such an extent that they should be considered an integral part of every good seeding job.

Stolons can be planted several ways, according to the locality and kind of grass. Stolons of bentgrasses are usually distributed over the soil surface and covered with a thin topdressing. Other planting methods are sprigging, planting the stolons in rows, and planting small pieces of sod on about one foot centers. New growth quickly fills in to form a dense sod.

Sod should be placed on a lightly-firmed soil surface at right angles to any slope. The pieces of sod usually are offset, in much the same manner that concrete blocks in a wall are offset, to minimize the chance of erosion between or under the sod strips by runoff water. The sod may also be held in place on slopes by wooden pegs driven into the ground through the sod. The pegs are removed once the sod becomes established.

Grasses are extensively used as lawn plants, but several broad-leaf plants, including Dichondera and Lippia, also produce a dense ground cover and can tolerate enough traffic to be used in lawns. They are generally used in the southern parts of the country. Refer to state extension service circulars for planting details.

Watering is vital in the establishment of a lawn. Newly-planted lawns should be kept moist at the soil surface at all times until adequate root systems develop. Fluctuating moisture levels can be devastating during the first few weeks. Mulching materials minimize this problem by conserving moisture and maintaining a more uniform moisture content. The basic steps involved in lawn establishment can be summarized as follows:

1. Studying the present condition of the lawn site
2. Planning the total operation
3. Rough-grading the area
4. Improving the soil by fertilizing, liming if necessary, and adding organic matter
5. Rotovating or otherwise working up the soil
6. Adding fertilizer and adjusting pH with lime, if necessary

7. Raking to finish the grade

8. Seeding, planting stolons, or laying sod

9. Watering

10. Mulching

The numerous state extension service circulars on lawns should be referred to for specific local lawn establishment procedures.

Suggested Teaching-Learning Activities

1. Give the students an unannounced, short (3-5 minute) quiz on the steps necessary to establish a lawn. Most, if not all, of the students will do poorly on this quiz. Do not record the grade, but point out that most of them did poorly because they did not plan for the quiz. If the test had been announced early enough, they could have studied the material.

   Point out the similarities between the test and lawn construction. Poor quality results from both, without advanced planning. Discussion should lead to the factors to be considered when planning a new lawn.

2. Discuss tile drainage systems. Have students estimate the materials needed to tile a small area on the school grounds.

3. Bring in samples of organic matter used locally for incorporation into the soil. Discuss advantages and disadvantages of each.

4. Have students practice adjusting and operating a rotary tiller or other equipment used locally for preparing soil. This practice should be under actual field conditions, if possible.

5. Each student should determine the square footage of an assigned area and the amount of fertilizer needed if a new lawn were to be planted. Have students find in state extension service circulars the fertilizer application recommendations for planting new lawns.

6. Display labeled samples of lawn grass seeds and grass seed mixtures. (Baby food jars are good display containers.) Note seed size differences and the affect of

size on the quantity of seed needed per standard area. Learn to identify lawn grasses by observing sod and individual grass plants in pots. Establish small, yard-square plots of different lawn grass plants. Conduct a contest on identification of these plants.

7. Obtain samples of stolons and several commercial-sized pieces of sod. Demonstrate methods of stolon-planting and procedures used in sodding. Allow students to practice planting stolons and laying sod if the opportunity should arise.

8. Emphasizing the correct techniques involved in "finish" raking, have students rake a previously tilled area. For finish-work, the rake should be held like an ordinary kitchen broom and used with short strokes, like sweeping the floor.

9. Have students practice using a lawn seed and fertilizer spreader to achieve uniform coverage and avoid waste. Sand can be used in the spreader and applied on a marked area of a parking lot, drive, or other bare area where a check can be made on evenness of distribution both in open areas and around obstacles. The sand can later be swept up, if necessary.

10. If possible, arrange to develop a new lawn area on or near the school grounds. This area should be of sufficient size to permit each student to practice each step of lawn establishment, but not so large as to interfere with the educational objectives. A small area, properly done, would add to the positive public image of the department.

Suggested Instructional Materials and References

Instructional materials

1. Samples of tile, gravel, and other materials used locally in drainage systems

2. Samples of organic matter

3. Rotray tiller or other mechanized equipment used for seedbed preparation

4. Samples of lawn grass seeds and potted samples of locally used grasses

5. Samples of stolons and sod

6. Spades, rakes, spreader, and other hand tools used in lawn establishment

7. Materials to establish a new lawn (if this activity is planned)

References

1. The Householder's Guide to Outdoor Beauty.

T*2. Lawns and Ground Covers.

T 3. The Lawn Book.

T 4. Turf Management.

5. Various state extension circulars on lawns.

*The symbol T (teacher) or S (student) denotes those references designed especially for the teacher or for the student.

Suggested time to develop the competency

Classroom teaching	7	hours
School laboratory activity	13	hours
Total time	20	hours

Suggested Occupational Experiences

1. Learn to grade and finish-rake.

2. Sow seed.

3. Plant stolons.

4. Lay sod.

II. To maintain a lawn properly

Teacher Preparation

Subject Matter Content

Proper lawn maintenance procedures are essential to a healthy turf, as the best constructed lawn will soon deteriorate if correct maintenance practices are not followed. Basis maintenance consists of proper mowing, weeding, watering, and fertilizing. Pest control and maintenance of soil condition are also important and necessary at all times.

Since large number of horticultural employees are engaged in lawn maintenance, they must establish their position and reputation by producing satisfactory results in working with lawns.

The frequency of mowing depends on the uses of the turf. Turf along roadsides or on golf course roughs may be cut only once or twice per season; whereas, golf course greens of the creeping or velvet bents are often cut daily for cultural reasons and for a fine carpet-like surface for playing.

The amount of available moisture and minerals and the temperature also affect frequency of mowing by affecting the growth rate of the grass. If conditions are limiting, the grass will not require mowing as often as when conditions are nearly ideal.

Grasses commonly used for turf in the northern states generally grow most vigorously in the spring and fall when environmental conditions are best. At these times mowing frequency is greatest. During midsummer, the grass growth rate usually decreases as does the frequency of mowing.

A rule of thumb concerning frequency of mowing is to mow whenever the grass is half again its usual mowing height. Use of this guide permits regulation of mowing frequency according to the growth rate of the grass. Close clipping generally increases work, rather than reducing it, because more weeds grow in a close-clipped grass lawn than in a tall mowed lawn. Also, close clipping does not delay the next mowing, because weed and vegetations growth shows more quickly. Close clipping, if it does anything, increases the frequency of mowing.

Grasses, as do all pruned plants, develop a balance between the root system and top growth. Once a mowing height has been established, it should be maintained, and the lawn cut often enough to prevent excessive cut back of overgrown plants.

Mowing heights vary according to the type of grass and, to some extent, the purpose for which the grass is intended. Upright, slow-growing grasses, such as bluegrasses, should not be continuously mowed to heights of less than 1¼ inches. Creeping grasses or other rapid-growing types can be successfully grown when maintained at heights of 1/2 to 3/4 inch. Some extremely fine grasses grown for special purposes are mowed down to 1/4 inch or less. Closer cutting can be done during the spring and fall when the grasses are growing rapidly. During midsummer, when growth slows down, the mower cutting height should be raised above suggested minimum heights.

There are both advantages and disadvantages to the removal of grass clippings. For economy, savings of labor, and return of all nutrients, including trace elements, to the soil, leaving the clippings is desirable. In some cases, leaving the clippings may encourage thatch and become unsightly. Whether or not to remove clippings, then, is a matter of judgement or personal preference.

Rotary mowers consist of a horizontally rotating blade which slices off the grass leaves. Rotary mowers are powered either by individual small gasoline engines or by the tractor on which they are mounted.

Mower height of cut adjustment is accomplished in several ways. All adjustments should be made while the mower is on a flat area to insure accuracy in adjustment. Mower adjustment should not be made in the field.

Reel mowers are usually adjusted for cutting height by moving the wheels vertically, thus changing the stationary or bed knife to the desired height for cutting.

Rotary mowers are also adjusted for height of cut by vertical wheel adjustment. Measurement of height must be made from blade to ground, not from the edge of the mower cover to the ground, as the blade is not at the same level as the edge of the mower cover. Rotary mowers are most easily adjusted when placed on a table where they can be conveniently seen and measured under the mower cover. Never adjust the height of rotary mowers unless the mower engine is turned off and the ignition wire removed from the spark plug.

Certain techniques are involved in mowing grass to give a smooth appearance. Each cut should be made to overlap the previous one and should be made in the opposite direction. The mower wheels depress the grass, but mowing in the opposite direction on the following cut causes this grass to be lifted and cut off evenly.

Avoiding mowing when the grass is wet from heavy rain or irrigation prevents grass ridges being left by the mower wheels.

The mower blade or blades should be kept sharp and well adjusted at all times for maximum performance. Since rotary mowers tend to draw or suck up dropping leaves into the cutting blade, and thin as well as mow the grass. Rotary-type mowers are more satisfactory on three-inch turf than are reel-type mowers.

Succeeding mowings should be made diagonally or at right angles to those made previously to eliminate the eventual compaction of the soil from wheel marks in the same tracks each mowing.

All plants require water to maintain their life processes and growth. Since large numbers of grass plants generally grow in a small area, the need for adequate water is very great.

Several factors affect the amounts of water needed by turf. The type of soil is an important factor since water leaches through sandy soil faster than through heavier soils. Refer to the module entitled Using Soil and Other Plant Growing Media Effectively for more information on soil-water relationships.

High temperature increases the rate of moisture evaporation from plants, which, in turn, increases their water requirements.

Water should be applied in sufficient quantity to penetrate 6 to 8 inches deep. Deep water penetration aids in the development of the extensive root system necessary for a vigorous turf.

When to water is difficult to determine. When regular rainfall occurs, supplemental watering may be needed only occasionally. When extended periods of drought occur, regular supplemental watering is necessary. In either case the time to water can be determined only by experience in the situation. The soil should be watered thoroughly, or 6 to 8 inches deep, when it begins to dry. It should begin to dry before being watered again. Regular light sprinkling is undesirable and in some instances is harmful, as it creates an inappropriate ecology, thus encouraging hydroplules. It may also promote the development of shallow root systems and stimulate fungus growth. Under certain circumstances, water stimulates undesirable crabgrass growth.

Equipment used for watering varies widely. Small movable sprinklers are satisfactory for small residential lawn watering. Golf courses, on the other hand, require larger and more extensive watering equipment. Owner-installable underground irrigation systems with movable surface sprinklers are available for both purposes. Automatic underground systems are also available

in plastic piping that requires no plumbing for installation.

Lawn fertilization and correction of improper acidity or alkalinity, supplement the minerals naturally found in the soil. Grasses, which tend to draw a considerable amount of minerals from the soil, must have sufficient quantities available throughout the season. Reference should be made to the module entitled Using Soil and Other Plant Growing Media Effectively for information on plant mineral usage.

In northern states fertilizer is applied prior to active turf growth in the spring and early fall. Under some circumstances, supplemental lighter application is made during the summer. Winter fertilization is also needed in the southern parts of the country where lawn grasses tend to grow throughout the year and where overseeding, such as winterseeding, is a necessary practice.

Two basic types of fertilizers are available.. These are either of a chemical nature, easily dissolved and quickly available to plants, or of an organic nature, available to plants slowly over a longer period of time.

Even distribution of fertilizer is important, especially with' chemical types, which if applied in too high a concentration can cause "fertilizer burn." Refer to the module Using Soil and Other Plant Growing Media Effectively for more information on over-fertilization damage.

Fertilizer spreaders are used commercially to obtain even fertilizer distribution. For information on use of the spreader to achieve even distribution, refer to the competency, in this module, pertaining to new lawn construction.

Pest control measures are at times necessary in a lawn maintenance program. Refer to the module entitled Recognizing and Controlling Plant Pests, and, for specific control measures, to state extension service circulars.

Suggested Teaching-Learning Activities

1. Refer to pots of grasses used earlier in this module. Have students list which grasses are upright in growth and which are of a low creeping growth. How does manner of growth affect the cutting heights of these grasses?

2. Demonstrate correct procedures and have students practice adjusting the height of cut on both reel and rotary mowers.

3. Have students practice mowing areas of school grounds using both a reel and a rotary mower, to learn to handle each and to discover the limitations of each type.

4. Demonstrate on the school grounds the effectiveness of water distribution of several available different types of sprinklers. Discuss advantages and disadvantages of each.

5. Practice using a fertilizer spreader. Refer to the competency in this module on establishing new lawns, teaching-learning activity number 9.

6. Assign to each student a separate area of the school lawn to determine when to mow, when to water, and, if possible, when and how much to fertilize. Evaluate the student's ability to manage these responsibilities on his own.

Suggested Instructional Materials and References

Instructional materials

1. Potted grass plants (used in earlier competency in this module)

2. Hand and power reel mowers, power rotary mower, and other large turf mowing equipment according to circumstances.

3. Several types of movable turf sprinklers

4. Fertilizer spreader

References

T 1. Grounds Maintenance Handbook. pp. 159-190.

2. The Lawn Book.

3. Turf Management. pp. 62-83, 175-177, 34-49.

4. The Householder's Guide to Outdoor Beauty.

5. State extension service circulars on lawns.

Suggested time to develop the competency

Classroom teaching	4	hours
School laboratory activity	11	hours
Total time	15	hours

III. To repair or renovate poor lawns

Teacher Preparation

Subject Matter Content

Renovation is a form of lawn maintenance which deals with the treatments needed to improve lawns which have deteriorated to the point where normal maintenance procedures cannot keep them in good condition.

The first step in attempting renovation of a lawn area is to determine the cause of the deterioration. It is unsound to attempt to correct a problem situation if one does not know what the problem is.

Possible causes of poor turf include:

1. Soil compaction
2. Poor drainage
3. Heavy matting (thatch)
4. Pest damage
5. Grasses not adapted to the situation
6. Competition from trees and shrubs
7. Poor maintenance practices
8. Physical damage

Soil compaction is caused by heavy traffic. The problem is more severe on heavier soils and when the traffic has occurred when the soil was wet. Correction is made by attempting to penetrate the compacted layer and allow air, moisture, and possibly organic matter into the upper soil layer. This is accomplished by hand or mechanized equipment. This permits easier access of air, water and minerals into the surrounding soil.

Power aerifiers which withdraw soil cores are used on larger expanses of lawns and can be rented from some garden centers or tool rental firms.

Necessary organic matter, lime, and fertilizer can be applied and worked into the holes in the sod. Cores left on the surface after aerifying can be broken up by dragging a mat over the surface or by brushing. This procedure also aids in the distribution of the organic matter, lime, and fertilizer into the holes.

Poor soil drainage can be the result of soil compaction or inadequate preparation before planting on a heavy soil. If the problem occurs in the surface layer and is due to compaction, aerification and frost during the winter months may help eliminate the problem. If the problem is due to inadequate soil preparation, the entire lawn area may need to be rebuilt, since major overhaul of the soil structure is needed.

When the grass is not mowed often enough or is too high, the stalks bend over and combine with the clippings to form a mat, called thatch, at the soil surface. It can become dense enough to form a water-repellent barrier at the soil surface. Remedial measures call for hand-raking or the use of a power verti-cutter to lift up the thatch and aeriate the turf.

Pest damage can become severe enough to ruin an established sod. Quite often, however, pest damage occurs in conjunction with some other turf problem. Refer to state extension circulars for current pest control recommendations. Pest control methods are discussed in the module Recognizing and Controlling Plant Pests.

Weeds can be quite troublesome in lawns, especially in those lawns having a poor stand of grass.

Lawn weeds are of two types:

1. Broadleaf weeds
2. Grass weeds

The following weed control measures may be applied:

1. Use of good management practices to establish a thick turf capable of crowding out competing weeds. Such practices include:

   a. Regular fertilization at the right seasons

   b. Liming as required to maintain a desirable pH

   c. Using quality seed

   d. Mulching to promote good germination of seed and a good stand of grass

   e. Regular high mowing

   f. Appropriate watering

2. Use of herbicides

   a. The 2, 4-D group

   b. The pre-emergent group

   c. Methyl arsenates

   d. General herbicides

Broadleaf weeds are controlled primarily by the use of 2, 4-D, Silvex and Neburon (for checkweed.) Fall is the best time for treatment with 2, 4-D, since weeds have insufficient time to become re-established before frost. Lawn grasses can fill in the vacant spaces in the spring before crab grass germinates. Also at this time, desirable plants susceptible to 2, 4-D injury are less likely to be injured. The 2, 4-D herbicide is available in both the amine and ester forms. The ester form is more volatile than the amine form and is more likely to cause injury to desirable plants. The manufacturer's directions for applying (rate and method) of 2, 4-D to lawns should be carefully followed.

Grass weeds are difficult to control with chemicals without harming desirable grasses. Grass weeds may be dug out or spot killed and the resulting bare spot reseeded. Pre-emergence chemicals, such as arsenicals, zytron, and dacthal, are effective against crabgrass and similar grasses. Post-emergence chemicals, such as the methyl arsenates, may be used to clean up crabgrass if prior control measures have either failed or not been used. The manufacturer's directions should be carefully followed in using the above-mentioned materials.

In cases where all vegetation is to be killed to keep an area clean, general herbicides are used. A variety of these are on the market. Information pertaining to them can be obtained from the local lawn supply center.

Not all lawn grasses will tolerate varied conditions. Some grasses cannot grow under shady, moist, dry, or heavy traffic conditions. Thus, a turf problem may stem from the use of unadaptable grasses, which must be removed and replaced with a grass capable of tolerating the situation. The use of lawn seed blends or mixtures is a good insurance against limited tolerance.

Trees or shrubs can induce turf problems through shading of the grass or through root competition for minerals or moisture. If grass is not necessary, some other ground cover plant which is adapted to the condition could replace it. Another remedy consists of cutting of the tree or shrub roots. Planning should precede action in this case, since the possible tree or shrub damage may be undesirable.

Proper maintenance is, of course, the basis for a successful turf.

Proper watering, fertilizing, and mowing procedures must be followed. Careless techniques lower the vitality of the turf, which, in turn, results in problems requiring remedial action. Proper watering, mowing, and fertilizing techniques are dealt with in the preceding competency.

Physical damage to the turf by various means often occurs, especially in public areas. Athletic fields, golf courses, and parks support activity sufficient to cause turf damage from sources such as shoe cleats, divots, or vehicles. Remedial measures involve aerification, replacement with sod, or reseeding.

Upon determining and eliminating, if possible, the cause of a turf problem, repair of the area must be undertaken.

Proper soil preparation is essential prior to reseeding or resodding. The soil should be loosened several inches and organic matter and fertilizer added, if necessary. If reseeding is done, a mulch usually is applied. Whether the area is reseeded or resodded, provision should be made for watering until the grass is established.

Suggested Teaching-Learning Activities

1. By using a soil-sampling tube or by digging a hole in a heavy-traffic area, show the appearance in a soil profile of excessive compaction. Compare with a like sample from a no-traffic area. Discuss the problems which develop from compaction. Show the difference in the appearances of roots in compacted and uncompacted soils.

2. Obtain dry samples of clay, sand, and a mix of equal parts of peat, sand, and loam. Place an equal quantity of each in pots of the same size and slowly pour the equal quantities of water into each pot. After drainage stops, measure the depth of water in each of the lower jars. Note that the clay soil tended to puddle, but finally absorbed much of the water, allowing little to filter through. The sand was the opposite extreme. Dump the soil from each pot into a separate pile and squeeze into a ball. Note that the clay stays in a sticky lump, whereas the sand tends to fall aprat. The mix appears to be the most satisfactory plant-growing medium, since it does not have the extreme characteristics of either clay or sand. Discuss the water problems encountered with clay and sand.

3. Take a walking field trip on the school grounds or in the neighborhood. Observe and discuss the following turf problems: thatch, pest damage, unadapted grasses, competition from trees and shrubs, poor maintenance (especially mowing), and physical damage.

4. Repair enough area of a lawn on or near the school grounds to enable each student to obtain practice in re-seeding or re-sodding.

5. De-thatch an area of the school grounds, using garden or thatching rakes or a verti-cut mower, if available.

6. Devote several laboratory periods to identifying the broadleaf and grass weeds which are lawn problems in the community. Indicate the chemical most effective in controlling each type of weed.

Suggested Instructional Materials and References

Instructional materials

1. Soil-sampling tube or spade

2. Samples of clay, sand, and peat-loam-sand mix; 3 pots and 6 bottles of the same size; ruler

3. Materials and tools for area to be renovated

4. Garden thatching rakes or verti-cut mower

5. Hand aerifier, power aerifier, or spading fork

References

1. Grounds Maintenance Handbook.

2. The Householder's Guide to Outdoor Beauty, pp. 154-162.

3. The Lawn Book.

4. Turf Management, pp. 168-173, 180-185.

5. State extension bulletins on lawns.

Suggested time to develop the competency

Classroom teaching	4	hours
School laboratory activity	6	hours
Total time	10	hours

Suggestions for Evaluating Educational Outcomes of the Module

This module is concerned with the various skills and abilities required to establish, maintain, and renovate lawns and turf. As a result of the knowledge acquired through study of this area, students should be able to perform the tasks listed below with a minimum of additional instruction by the employer. The following questions can be used as a check list for evaluating student achievement:

1. Does the student understand the need for advanced planning?

2. Can the student plan a simple tile-drainage system, including development of an estimate of materials and costs?

3. Can the student adjust and operate a rotary tiller?

4. Can the student identify lawn grasses and plants used in the area?

5. Can the student use the rake to "finish rake" an area?

6. Can the student use a seeder and fertilizer spreader properly?

7. Can the student adjust reel and rotary mowers properly?

8. Can the student mow properly, using reel and rotary mower?

9. Does the student understand proper watering procedures for lawns?

10. Can the student effectively operate the aerifier and verticutter?

11. Can the student identify common lawn pests and prescribe and apply the proper control measure?

12. Can the student calculate the correct amount of a specific analysis fertilizer for a specific area?

Sources of Suggested Instructional Materials and References

1. Conover, H. S. Grounds Maintenance Handbook. Second Edition. New York: McGraw-Hill Book Company, 1958. Price: $15.

2. Musser, H. B. Turf Management. New York: McGraw-Hill Book Company, 1962.

3. Schery, Robert W. The Householder's Guide to Outdoor Beauty. New York: Pocket Books, Inc. 1963. Price: $.50.

4. The Lawn Book. New York: McMillan. Price: $5.95.

5. Sunset Editorial Staff. Lawns and Ground Covers. Menlo Park, California: Lane Book Company, 1964. Price: $1.95.

6. Various state extension service circulars concerning lawns and turf.

THE CENTER FOR RESEARCH AND LEADERSHIP DEVELOPMENT
IN VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY
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COLUMBUS, OHIO, 43212

INSTRUCTOR NOTE: As soon as you have completed teaching each module, please record your reaction on this form and return to the above address.

1. Instructor's Name_____

2. Name of school_____State_____

3. Course outline used: _____Agriculture Supply--Sales and Service Occupations
_____Ornamental Horticulture--Service Occupations
_____Agricultural Machinery--Service Occupations

4. Name of module evaluated in this report_____

5. To what group (age and/or class description) was this material presented?____
_____

6. How many students:
a) Were enrolled in class (total) _____
b) Participated in studying this module _____
c) Participated in a related occupational work experience program while you taught this module _____

7.

Actual time spent teaching module:		Recommended time if you were to teach the module again:
_____hours	Classroom Instruction	_____hours
_____hours	Laboratory Experience	_____hours
_____hours	Occupational Experience (Average time for each student participating)	_____hours
_____hours	Total time	_____hours

(RESPOND TO THE FOLLOWING STATEMENTS WITH A CHECK (✓) ALONG THE LINE TO INDICATE YOUR BEST ESTIMATE.)

	VERY APPROPRIATE	NOT APPROPRIATE
8. The suggested time allotments given with this module were:		
9. The suggestions for introducing this module were:		
10. The suggested competencies to be developed were:		
11. For your particular class situation, the level of subject matter content was:		
12. The Suggested Teaching-Learning Activities were:		
13. The Suggested Instructional Materials and References were:		
14. The Suggested Occupational Experiences were:		

(OVER)

15. Was the subject matter content sufficiently detailed to enable you to develop the desired degree of competency in the student? Yes_____No_____
Comments:

16. Was the subject matter content directly related to the type of occupational experience the student received? Yes_____No_____
Comments:

17. List any subject matter items which should be added or deleted:

18. List any additional instructional materials and references which you used or think appropriate:

19. List any additional Teaching-Learning Activities which you feel were particularly successful:

20. List any additional Occupational Work Experiences you used or feel appropriate:

21. What do you see as the major strength of this module?

22. What do you see as the major weakness of this module?

23. Other comments concerning this module:

_____ _____
(Date) (Instructor's Signature)

_____
(School Address)